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December 2 to 4, 2002

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Abstract Volume

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Cover (clockwise from top left):

Matthew Senkow (geological assistant) examining felsite near Many Islands Lake in the Phelps Lake (64M) area.

Gary Yeo measuring crossbeds in oriented core from the Manitou Falls Formation, Athabasca Basin.

Examination of core from the Jansem copper showings, Janice Lake area, Wollaston Domain.

Ralf Maxeiner explaining the geology of the Peter Lake Domain along Highway 905.

Gary Yeo, Colin Card, and Rick Kulach (geological assistant) contemplating on a outcrop of the Manitou Falls Formation at Dufferin Lake.

Geological assistants Chad Leugner and Kimberley Bailey mapping near Flin Flon.

Photos by staff of Saskatchewan Energy and Mines.

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Publications
2101 Scarth Street, 3rd floor
Regina, SK S4P 3V7
(306) 787-2528
FAX: (306) 787-2527
E-mail: publications@ir.gov.sk.ca

Editor:
G.D. Delaney

Production Editor:
C.L. Brown

Production Assistants:
S. Wolfe
A. Tong

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Note that the registrants of the Saskatchewan Geological Survey Open House 2002, are entitled to the Summary of Investigations 2002, Volume 2 CD-ROM. This will be made available in December and will be mailed out to Open House registrants.

A. Northern Mapping (full papers available on Summary of Investigations 2002, Volume 2 CD-ROM)

Phelps Lake Project: Geology and Mineral Potential of the Keseechewun Lake–Many Islands Lake Area (parts of NTS 64M-9, -10, -15, and -16)

C.T. Harper, R.J. Wolbaum, S. Thain, M. Senkow, D. Weber, M. Gunning, and K. MacLachlan

Harper, C.T., Wolbaum, R.J., Thain, S., Senkow, M., Weber, D., Gunning, M., and MacLachlan, K. (2002): Phelps Lake Project: Geology and mineral potential of the Keseechewun Lake–Many Islands Lake area (parts of NTS 64M-9, -10, -15, and -16); *in* Summary of Investigations 2002, Volume 2, Saskatchewan Geological Survey, Sask. Industry Resources, Misc. Rep. 2002-4.2, CD-ROM.

Abstract

The multiyear Phelps Lake Project continued in 2002 with 1:100 000 scale bedrock and surficial mapping and complimentary mineral occurrence studies in the Keseechewun Lake–Many Islands Lake area in the northeast part of the Phelps Lake map area (64M). This work identified the eastern continuation of potential Archean basement tonalitic and granitic migmatite complexes. Several smaller belts of dominantly mafic metavolcanic rocks, equivalent to the Archean Ennadai Group (ca. 2.71 to 2.6 Ga), occur in the western part of the area. Gneissic granite and tonalite, believed to be late Archean (ca. 2.6 to 2.55 Ga), intruded the migmatites and Ennadai Group rocks, but do not intrude the younger Hurwitz Group (ca. 2.45 to 1.9 Ga) supracrustal rocks. The Hurwitz Group is dominated by metasedimentary rocks and occupies two regional synclinoria in the east half of the area. The group comprises a lower pelitic sequence (correlated with the Ameto Formation), a middle carbonate sequence (correlated with the Watterson Formation), and an upper psammopelitic-pelitic sequence (correlated with the Ducker Formation). Ferruginous and copper-bearing pelites and thin zones of iron formation in the lower sequence make it more attractive for mineral exploration. Sills, dykes, sheets, and smaller plutons of generally massive, red to pink granite, leucogranite, and locally fluoritic granite and pegmatite represent a suite of late- to post-tectonic intrusions. Small-scale structures in Hurwitz Group pelites indicate that both northwest- and southeast-directed basement-cover detachment occurred during Trans-Hudson deformation as the group was squeezed between basement arches.

Mineral occurrences noted include: i) narrow zones of banded silicate-sulphide facies (quartz-garnet-amphibole-biotite-iron sulphides) and oxide facies (quartz-magnetite) iron formations in both Ennadai and Hurwitz groups; ii) disseminations of pyrite, pyrrhotite, and chalcopyrite in Ennadai Group mafic metavolcanic rocks; iii) structurally controlled pyritic quartz veins in metavolcanic rocks; iv) disseminated chalcopyrite and malachite coatings on fractures in Hurwitz Group ferruginous pelites; v) molybdenite in granite; vi) allanite±molybdenite± pyrite-bearing granitic and tonalitic migmatites; and vii) weakly pyritic quartz-tourmaline veins in granite. Rare earth elements are potential targets associated with late massive fluoritic granites, leucogranites and granite pegmatites.

Phelps Lake Project: Highlights of the Quaternary Investigations in the Keseechewun Lake Area (NTS 64M-9, -10, -15, and -16)

J.E. Campbell

Campbell, J.E. (2002): Phelps Lake Project: Highlights of the Quaternary investigations in the Keseechewun Lake area (NTS 64M-9, -10, -15, and -16); *in* Summary of Investigations 2002, Volume 2, Saskatchewan Geological Survey, Sask. Industry Resources, Misc. Rep. 2002-4.2, CD-ROM.

Abstract

Quaternary geological investigations continued this past summer in the Keseechewun Lake area (64M-9, -10, -15, and -16) as part of the multidisciplinary, multi-year Phelps Lake Project. The Quaternary component of the project involves surficial geological mapping at 1:100 000 scale, studying the glacial history, and conducting regional till sampling surveys.

Although the striae record is sparse, multiple ice flow directions were documented. The dominant ice flow direction is to the south-southwest. Initial flow was towards the south followed by a swing to south-southwest as the Keewatin ice divide shifted eastward. Two rare, faint striae sets trend 157°/337° and 270°/90°. Their relative ages were not established, but they are believed to predate the southerly flow.

Drift cover is extensive with till, boulder fields, and organic terrain being the dominant surface materials. In addition, there are several substantial sand and gravel deposits, primarily associated with large esker-kame complexes which cross the entire map area. Evidence of proglacial lake(s) were found in the form of cobble beaches and terraces. The dominant glacial landforms are ground moraine, boulder fields, stagnant ice moraine, ridged moraine, and low-relief streamlined features.

As in the Bonokoski Lake area, boulder and block fields are prominent. Change in the rock type of the boulders generally corresponds to change in underlying or nearby bedrock. The greatest abundance of these block fields occur in regions of thin drift of bouldery till overlying granitic terrain.

Ridged moraines, stagnant ice moraine, and well-developed esker systems with ice contact deltas are evidence of a slowly retreating, downwasting ice margin. A recessional end moraine west and south of Hasbala Lake marks a stationary ice frontal position during deglaciation of the region. Ice retreat was dominated by downwasting of the ice sheet, which would have produced abundant meltwater, which likely drained subglacially towards the ice margin through subglacial channels and as periodic high-volume, turbulent sheet floods. Subglacial meltwater erosion played a major role in the formation of the present day landscape.

A Geological Transect Across the Southwestern Peter Lake Domain, Saskatchewan

Ralf O. Maxeiner and Rebecca Hunter [1]

Maxeiner, R.O. and Hunter, R. (2002): A geological transect across the southwestern Peter Lake Domain, Saskatchewan; *in* Summary of Investigations 2002, Volume 2, Saskatchewan Geological Survey, Sask. Industry Resources, Misc. Rep. 2002-4.2, CD-ROM.

Abstract

The largely Archean Peter Lake Domain is wedged between the Wollaston Domain to the northwest and the Paleoproterozoic Wathaman Domain to the southeast, bounded in part by the Needle Falls Shear Zone and the Parker Lake Shear Zone, respectively. Its perceived high platinum group element potential and ambiguous geological history and setting prompted the Saskatchewan Geological Survey to initiate a detailed three-year mapping project. Historically, the domain has been subdivided into three main components: the Peter Lake Complex, its high-strain equivalents called the Parker Lake Gneisses, and a low-grade sedimentary succession, the Campbell River Group. In the first year of the project, a 40 km long and 10 to 15 km wide transect flanking Highway 905 was mapped between Courtenay Lake and the Wathaman River. The poorly exposed northern half of the map area comprises large intrusions of massive to weakly foliated syenogranite, part of which is fluorite-bearing, and a dioritic to gabbroic suite. The southern half of the domain is better exposed and is underlain by massive to mylonitic, mafic to felsic plutonic rocks, including leucogabbroic to anorthositic, gabbroic, and dioritic suites, as well as younger granodioritic, monzonitic, and granitic intrusive suites. The Love Lake leucogabbro contains rare examples of well preserved primary igneous layering. Locally abundant fine-grained mafic xenoliths in the pluton have a tectonic foliation predating the fabric in the host. Several slivers of upper amphibolite facies migmatitic supracrustal rocks are between Peter Lake and the Wathaman River, as well as a 0.2 to 1.5 km outlier of lower amphibolite facies Campbell River Group quartzite and argillite containing well preserved primary sedimentary structures including crossbedding, and ball-and-pillow structures. The structural history included at least four ductile deformational events, two main regional metamorphic events, and late brittle faulting.

Several outcrops contain disseminated iron sulphides, chalcopyrite, and rare azurite. Geochemical analyses of grab samples have not returned significant values of gold, copper, and/or platinum group elements.

[1] Department of Geological Sciences, University of Saskatchewan, 114 Science Place, Saskatoon, SK S7N 5E2

B. Northern Mineral Deposits (full papers available on Summary of Investigations 2002, Volume 2 CD-ROM)

Rare Earth Element and Other Mineral Occurrences in the Phelps Lake Region (NTS 64M)

D. G. MacDougall

MacDougall, D.G. (2002): Rare earth element and other mineral occurrences in the Phelps Lake region (NTS 64M); *in* Summary of Investigations 2002, Volume 2, Saskatchewan Geological Survey, Sask. Industry Resources, Misc. Rep. 2002-4.2 CD-ROM.

Abstract

Rare earth element (REE) occurrences in the Phelps Lake region (NTS 64M) are hosted by: (a) pegmatitic and granitic leucosome and intrusions in migmatized supracrustal rocks; (b) allanite-bearing migmatitic gneiss; and (c) late fluoritic monzogranite intrusions. Results of investigations conducted in 2001 and 2002 confirm that high Th/U ratios in these host rocks can be used as a reliable guide to unusually high concentrations of REE-bearing minerals. Geochemical results for samples taken from a number of disseminated to massive sulphide occurrences listed in the Saskatchewan Mineral Deposits Index are also reported. The range of elements analyzed was extended to include elements not previously analyzed, including platinum group metals (PGM), additional base metals, gold, and a full range of trace and major elements.

Base metal potential of supracrustal rocks outside of the Ennadai Group rocks is low; the highly migmatized nature of supracrustal rocks folded into the Mudjatik granitoids is not conducive to the preservation of base metal deposits. Elevated but erratic base metal content of sulphides in felsic and mafic metavolcanic rocks and related volcanogenic metasediments in the Hatle Lake area reaffirms the well-established regional potential of the Ennadai Group to host VMS deposits.

In the Ennadai Group, lithologies most likely to host gold are silicate and mixed sulphide-silicate facies banded iron formations. Quartz vein material is consistently barren of gold.

Stratigraphic and Intrusive Relationships in the Myo Lake Section, Flin Flon Mine Sequence, Creighton, Saskatchewan

K. MacLachlan, H. Gibson[1], and K. Bailey[2]

MacLachlan, K., Gibson, H., and Bailey, K. (2002): Stratigraphic and intrusive relationships in the Myo Lake Section, Flin Flon mine sequence, Creighton, Saskatchewan, *in* Summary of Investigations 2002, Volume 2, Sask. Industry Resources, Misc. Rep. 2002-4.2, CD-ROM.

Abstract

A section through the western limb of the Beaver Road anticline in the Flin Flon Mining Camp was mapped at 1:2000, and in part at 1:500. The section was sampled in detail for whole-rock lithogeochemistry to compare the chemostratigraphic evolution of this part of the volcanic complex with that of the immediate host succession of the massive sulphide deposits on the eastern limb of the Beaver Road anticline. Crosscutting relationships and distribution of mafic and felsic dykes and sills were also recorded in detail and representative samples were collected from each phase. The footwall section, below the Myo rhyolite, which is correlated with the mine succession on the eastern limb, is characterized by dyke swarms and synvolcanic faulting. The latter has produced grabens into which the volcaniclastic rocks were deposited. The orientation, location, and density of synvolcanic dykes and faults might be a useful exploration tool within the footwall succession, informally referred to as the "Creighton Formation". The hanging-wall succession, above the Myo rhyolite, comprises predominantly pillowed and massive aphyric flows and synvolcanic sills that erupted or intruded into thinly bedded to laminated, fine-grained sediments with minor rhyolitic rocks. This succession is tentatively correlated with the "Hidden Formation" based on a broad similarity in lithology and stratigraphic position relative to the "mine succession".

[1] Laurentian University, 935 Ramsey Lake Road, Sudbury, ON P3E 2C6.
[2] University of Regina, 3737 Wascana Parkway, Regina, SK S4S 0A2.

Geology and Hydrothermal Alteration of the Flin Flon–Triple 7–Callinan VMS Horizon Hanging-wall Stratigraphy: Flin Flon Targeted Geoscience Initiative

D.E. Ames [1], N. Tardif, [2], K. MacLachlan, and H.L. Gibson [2]

Ames, D.E., Tardif, N., MacLachlan, K., and Gibson, H.L. (2002): Geology and hydrothermal alteration of the Flin Flon–Triple 7–Callinan VMS horizon hanging-wall stratigraphy: Flin Flon Targeted Geoscience Initiative; *in* Summary of Investigations 2002, Volume 2, Sask. Industry Resources, Misc. Rep. 2002-4.2,CD-ROM.

Abstract

The objective of this sub-project of the Flin Flon Targeted Geoscience Initiative (FFTGI) is to gain a better understanding of the nature and distribution of hydrothermal alteration within the hanging-wall strata, herein informally called the "Hidden Formation"[3], to the Flin Flon-Triple Seven-Callinan volcanogenic massive sulphide (VMS) deposits of the Paleoproterozoic Flin Flon belt.

Important findings to date from this study include:

1) *The recognition of extensive zones of hydrothermal alteration within the hanging-wall strata, including both distal and proximal alteration facies.*
2) *The definition of two distinct, synvolcanic dyke swarms within the "Hidden" and "Louis" formations, one of which includes felsic dykes. Dyke swarms are important for localizing hydrothermal fluid upflow zones.*
3) *The recognition of a rhyolite flow unit with associated sulphidic sedimentary rocks called the "Tower Member" of the "Hidden Formation". This increases the exploration potential for another VMS-bearing horizon in the Flin Flon area at the upper contact of the "Hidden Formation" with the "Louis Formation".*

[1] Geological Survey of Canada, 601 Booth Street, Ottawa, ON K1A 0E8.
[2] Laurentian University, 935 Ramsey Lake Road, Sudbury, ON P3E 2C6.
[3] Informal stratigraphic names are in italics surrounded by quotation marks.

Stratigraphy of VMS-hosting Volcanic and Volcaniclastic Rocks of the Flin Flon Formation, Flin Flon–Creighton area, Saskatchewan and Manitoba

C.A. Devine [1], H.L. Gibson [1], A.H. Bailes [2], K. MacLachlan, K. Gilmore [3], and A.G. Galley [4]

Devine, C.A., Gibson, H.L., Bailes, A.H., MacLachlan, K., Gilmore, K., and Galley, A.G. (2002): Stratigraphy of VMS-hosting volcanic and volcaniclastic rocks of the Flin Flon Formation, Flin Flon–Creighton area, Saskatchewan and Manitoba; *in* Summary of Investigations 2002, Volume 2, Saskatchewan Geological Survey, Sask. Industry Resources, Misc. Rep. 2002-4.2, CD-ROM.

Abstract

Detailed stratigraphy, 1:500 scale mapping, and clast counts and descriptions have established several distinctive eruptive and volcaniclastic members of the "Flin Flon Formation", which comprises the footwall stratigraphy to the Flin Flon, Triple 7, and Callinan volcanogenic massive sulfide deposits. The volcaniclastic rocks were emplaced within a structurally controlled depression or "basin" by high and low concentration mass flows. Stratigraphy is repeated by early thrust faults and associated drag folds. The aim of this work is to produce a more comprehensive analysis of the present position of the VMS horizon in three dimensions.

[1] Mineral Exploration Research Centre, Department of Earth Sciences, Laurentian University, Sudbury, ON P3E 2C6.
[2] Manitoba Geological Survey, 1395 Ellice Avenue, Suite 360, Winnipeg, MB R3G 3P2.
[3] Hudson Bay Exploration and Development, Box 1500, Flin Flon, MB R8A 1N9.
[4] Geological Survey of Canada, 601 Booth Street, Ottawa, ON K1A 0E8.

Relationships Between Ore and Overprinting Structures at the Konuto Lake VMS Deposit, Flin Flon Domain

G. Tourigny, K. Gilmore [1], L. Howland [2], and J. Levers [2]

Tourigny, G., Gilmore, K., Howland, L., and Levers, J. (2002): Relationships between ore and overprinting structures at the Konuto Lake VMS deposit, Flin Flon Domain; *in* Summary of Investigations 2002, Volume 2, Saskatchewan Geological Survey, Sask. Industry Resources, Misc. Rep. 2002-4.2, CD-ROM.

Abstract

The Konuto Lake Mine, in the Flin Flon mining district, is a 1.3 million tonne copper-zinc deposit that has been in operation since 1998. The deposit is hosted by mafic metavolcanic rocks and consists of sulphide breccias and stockwork ore types mainly composed of chalcopyrite-pyrrhotite-sphalerite and minor pyrite. Five ore lenses occur within a broad zone of inhomogeneous deformation recording evidence of oblique-reverse faulting. Contacts between competent basaltic flows and ductile sulphide bodies are typical structural discontinuities. The ore has been locally remobilized into extensional veins, dilational jogs, and piercement structures. These dilational structures are widespread in the deposit and create high-grade ore shoots either concordant or discordant to the enveloping surface of individual ore lenses.

Konuto is a Cyprus-type VMS deposit based on mafic host rocks, ore types, metal contents, and back-arc setting environment. It is interpreted as a syn-volcanic stockwork deposit that was subsequently deformed, recrystallized, and partly remobilized during the Trans-Hudson Orogeny.

[1] Hudson Bay Exploration and Development., Box. 1500, Flin Flon, MB R8A 1N9.
[2] Hudson Bay Mining and Smelting Co., Ltd., Box. 1500, Flin Flon, MB R8A 1N9.

Mineralized Core Collection

A.J. Gracie

Gracie, A.J. (2002): Mineralized core collection; *in* Summary of Investigations 2002, Volume 2, Saskatchewan Geological Survey, Sask. Industry Resources, Misc. Rep. 2002-4.2, CD-ROM.

Most of the mineralized core collection is housed at the Precambrian Geological Laboratory in La Ronge with some unmineralized stratigraphic uranium cores at the Subsurface Laboratory in Regina. The mineralized core collection has been described in previous summary reports (e.g. Gracie 2001) and in an index to the collection (Gracie and Scutt, 1990). The index identifies the location of all cores by latitude and longitude on 1:250 000 scale maps, and gives full particulars of each hole: company, mineral disposition, exploration commodity, year, hole number, core size, hole bearing and inclination, length of sample, reference to other exploration data, and storage. The database has been converted to Microsoft Access97 and updated to August 31, 2002. Xerox and diskette (excluding location maps) copies of the database are available from the La Ronge office. Complete copies of the index (including maps) are available in La Ronge and Regina. Versions 2 to 5 of the Geological Atlas of Saskatchewan CD include the La Ronge mineralized core collection drill holes as a separate geological data set theme.

A total of 2154.05 m of unconcentrated and 4669.44 m of concentrated core were collected in 2001-02 (Table 1). The unconcentrated holes were from base metals (63 percent), uranium (30 percent), and gold (7 percent). The unmineralized uranium cores were collected for stratigraphic purposes. The concentrated core, gold (100 percent), is an interesting Laural Lake core collection contributed by Claude Resources Inc. Ten core boxes from eight very incomplete holes are not included in Table 1.

The core collection has been augmented by an extensive suite of rock samples from mineral properties in northern Saskatchewan. The index to the sample collection lists all samples by mineralization, type, property, longitude, latitude, topographic location, lithology, mineral of interest, collector, and date. Xerox and diskette copies of this database are also available from the La Ronge office.

References

Gracie, A.J. (2001): Mineralized core collection; *in* Summary of Investigations 2001, Volume 2, Saskatchewan Geological Survey, Sask. Energy Mines, Misc. Rep. 2001-4.2, CD A, p131.

Gracie, A.J. and Scutt, A.G. (1990): Index to La Ronge core collection; Sask. Industry and Resources, Data File 15, 228p.

Table 1 - Core acquisitions (September 1, 2001 to August 31, 2002).

Company or Joint Venture Operator	Commodity	NTS Area	No. of Holes	Core Size	Property/Deposit Location by Lake	Core Length (m)
Mineralized Core						
Leader Mining	Cu, Zn	63M-14	1	NQ	Red Hill Lake	151.79
	Cu	63M-15	3	NQ	Knife Lake	240.90
Claude Resources Inc.	Au	63M-12	1	Axt	Seabee Mine	150.00
Hudson Bay	Cu, Zn	63L-7	1	NQ/BQ	Suggi Lake	159.50*
	Cu, Zn	63L-9	1	BQ	Konuto Lake	196.38
	Zn	63L-16	1	BQ	Matheson Lake	164.90
Foran Mining	Cu, Zn	63L-10	2	NQ	McIlvenna Bay	201.34
Golconda Resources	Cu, Zn, PGM	73I-15	1	NQ	Wapawekka Lake	241.24
Sask. Mining Dev. Corp.	Au	63L-9	35**	NQ	Laural Lake	4669.44†
Stratigraphic Core						
Cameco Corporation	U	74G-14	1	NQ	Stewardson lake	648.00‡

Notes:
* Incomplete: 3 m of core missing.
† Concentrated core: Actually the record consists of unsystematically concentrated holes and split sections from incomplete holes representing 4669.44 m.
‡ DDH.VIR.01, which took several years to collect, is now stored complete in the Subsurface Geological Laboratory, Regina. Six hundred and forty-eight metres is an approximate figure.

C. Industrial Mineral Studies (full papers available on Summary of Investigations 2002, Volume 2 CD-ROM)

Economic Potential of Formation Brines: Interim Results from the Saskatchewan Brine Sampling Program

B.J. Rostron [1], L.I. Kelley, L.K. Kreis, and C. Holmden [2]

Rostron, B.J., Kelley, L.I., Kreis, L.K., and Holmden, C. (2002): Economic potential of formation brines: Interim results from the Saskatchewan brine sampling program; *in* Summary of Investigations 2002, Volume 2, Saskatchewan Geological Survey, Sask. Industry Resources, Misc. Rep. 2002-4.2, CD-ROM.

Abstract

Analytical results are presented for 305 samples of formation waters from across Saskatchewan and surrounding areas. Samples were obtained from water source wells, producing oil wells with high water cuts (>50%), from drill-stem tests, and from grab samples (e.g., surface springs and seepages in potash mines). These data are compared to chemical data for economic brines that are either extracted for the sole purpose of mineral production or are co-produced during petroleum extraction. This comparison highlights opportunities for production or co-production of K, Mg, Ca, I, Br, and Li from Saskatchewan brines.

[1] Department of Earth and Atmospheric Sciences, University of Alberta, Edmonton, AB T6G 2E3.
[2] Department of Geological Sciences, University of Saskatchewan, Saskatoon, SK S7N 5E2.

Geology of the Hoidas Lake Area, Ena Domain, Northwestern Saskatchewan

S.E. Harvey, I. Young [1], and G. Billingsley [1]

Harvey, S.E., Young, I., and Billingsley, G. (2002): Geology of the Hoidas Lake area, Ena Domain, northwestern Saskatchewan; *in* Summary of Investigations 2002, Volume 2, Saskatchewan Geological Survey, Sask. Industry Resources, Misc. Rep. 2002-4.2, CD-ROM.

Abstract

The structurally controlled Hoidas Lake rare-earth element (REE) deposit is near the eastern edge of the Ena Domain, 60 km northeast of Uranium City, and 3 km west of the Black Bay Fault. Current research on the deposit and the surrounding area included 1:10 000 scale regional mapping, more detailed 1:2 500 scale property mapping on a cut grid, and the logging of NQ core from five holes through the deposit. The purpose of the work was to establish a regional framework for the REE mineralization.

In the 1950s, allanite showings were discovered along a strike length of 10 km in the Nisikkatch-Hoidas lakes area. Grab samples from the northwest side of Hoidas Lake contained up to 7% Ce, 6% La, 2% Th, and total rare-earth element concentrations up to 12%. In the late 1990s, the main Jak zone was systematically trenched and sampled and then tested by diamond drilling in 2001. Intervals up to 6.9 m thick contained 4.4% total rare-earth oxides, and metallurgical work indicated that 95 to 99% of the REEs could be extracted using readily available, non-toxic reagents to leach the elements.

Regionally, granitic and tonalitic gneisses dominate and intrude amphibolite that exhibits local compositional layering (S_0). Late intrusive rocks include garnetiferous dioritic gneiss and granitic pegmatite. Early D_1 deformation produced isoclinal folds parallel to a locally preserved S_1 foliation. This was overprinted by northeast-trending D_2 shearing and tight to isoclinal folding. The intensity of the S_2 foliation is highly variable, ranging from weakly gneissic west of Hoidas Lake to mylonite (<500 m wide) coincident with the lake, and in local narrow zones to the east. Rare kinematic indicators suggest oblique-dextral movement in the ductile shear zones. Late faults and fractures trend in three general directions: east, northeast, and southeast. The northeast-trending set appears to overprint older D_2 shear structures and is probably related to the Black Bay Fault.

REE minerals are in a 60m wide system of veins in northeast-trending fractures/faults; they have a drill-defined strike length of at least 475 m. Individual veins are up to 5 m wide and have a variably developed mineral zonation defined by two main phases: a pyroxene-rich zone of clinopyroxene, scapolite, allanite and amphibole; and an apatite-rich zone of apatite and allanite. The paragenesis of these veins remains ambiguous and requires further study, however, initial work suggests that they may be the result of metasomatism/metamorphism of a pyroxene-rich ultramafic to lamprophyric vein/dyke system that intruded northeast-trending brittle-ductile to brittle fault/fracture zones. An influx of calcium-enriched fluids during/after initial vein emplacement resulted in production of pyroxene-scapolite-rich and apatite-rich rocks. Abundant late, thin peridotitic and pyroxenitic dykes and lenses near the Black Bay Fault and the Tazin Lake Fault to the southwest might be associated with those which host the Hoidas Lake deposit and may be a target for future exploration.

[1] Great Western Minerals Group Ltd., P.O. Box 69, Saskatoon, SK S7K 3K1.

New Multidisciplinary Geological Studies in the Fort à la Corne Kimberlite Field

B.A. Kjarsgaard [1], J.-P. Zonneveld [2], S. Harvey, L. Heaman [3], D. McNeil [2], J. Mwenifumbo [1], and D. White [1]

Kjarsgaard, B.A., Zonneveld, J.-P., Harvey, S., Heaman, L., McNeil, D., Mwenifumbo, J., and White, D. (2002): New multidisciplinary geological studies in the Fort à la Corne kimberlite field; *in* Summary of Investigations 2002, Volume 2, Saskatchewan Geological Survey, Sask. Industry Resources, Misc. Rep. 2002-4.2, CD-ROM.

Abstract

Recent geological investigations in the Fort à la Corne kimberlite field by the Geological Survey of Canada and Saskatchewan Industry and Resources Targeted Geoscience Initiative project team are presented. These studies have concentrated on examining new core from the 140/141 body (Fort à la Corne joint venture of De Beers, Kensington, and Cameco) and the Star body (Shore Gold) drilled in 2000 and 2001. New data includes results from micropaleontology studies, U-Pb perovskite age dating, and downhole geophysical logging, which has been integrated with sedimentological and volcanological studies based on detailed core logging. A high-resolution 2D and 3D seismic survey is currently being undertaken on the 140/141 and Star bodies.

[1] Geological Survey of Canada, 601 Booth Street, Ottawa, ON K1A 0E8.
[2] Geological Survey of Canada, 3303 - 33rd Street, NW, Calgary, AB T2L 2A7.
[3] University of Alberta, Department of Earth and Atmospheric Sciences, Edmonton, AB T6G 2E3.

Sedimentary Constraints on Kimberlite Emplacement in the Fort à la Corne Kimberlite Field

J.-P. Zonneveld [1], B.A. Kjarsgaard [2], S.E. Harvey ,and K.Y. Marcia [3]

Zonneveld, J.-P., Kjarsgaard, B.A., Harvey, S.E., and Marcia, K.Y. (2002): Sedimentary constraints on kimberlite emplacement in the Fort a la Corne kimberlite field; *in* Summary of Investigations 2002, Volume 2, Saskatchewan Geological Survey, Sask. Industry Resources, Misc. Rep., 2002-4.2, CD-ROM.

Abstract

Diamond-bearing kimberlite complexes in the Fort à la Corne region of east-central Saskatchewan are among the most complete examples in the world, preserving kimberlite within pipes and maar-shaped craters as well as extensive extra-pipe sheets of both primary and secondary pyroclastic kimberlite. Interstratification of extra-pipe kimberlite with Lower Cretaceous (Albian) marine, marginal marine, and continental sediments reveals a prolonged and complex history of repeated kimberlite volcanism with lengthy temporal hiatuses separating individual eruption events. Radiometric age determination (U-Pb perovskite) and micropaleontologic evidence (from foraminifera and palynomorphs) support the hypothesis that multiple kimberlite eruptive phases occurred.

The oldest kimberlites in the Fort à la Corne region erupted during deposition of the predominantly continental strata of the Cantuar Formation (lower Mannville Group). Primary Cantuar kimberlite is relatively rare in the study area, however, fluvially transported kimberlitic sandstone and conglomerate are common. Rare, thin terrestrial airfall deposits also occur. These deposits provide evidence that kimberlites older than the primary exploration targets occur either within the Fort à la Corne area or in a paleo 'upstream' direction.

One of the main eruptive intervals coincided with deposition of the marginal marine (shoreface-estuarine/deltaic) Pense Formation. Evidence of grain flow and talus slope deposits within the crater support the interpretation of many of these early kimberlite occurrences as asymmetrical maar-shaped volcanoes. Low-relief tuff rings/cones proximal to the volcanic centers grade distally into large, laterally extensive sheets of primary airfall kimberlite. Subsequent volcanic pulses (during the later part of the Pense interval) resulted in partial crater infill. Superimposed on this record of episodic volcanism is a chronicle of periodic fluctuations in local sea level. This is evidenced by interfingering of fine- to medium-grained cross-stratified kimberlitic (olivine dominated) sandstone with primary airfall kimberlite.

Intermittent eruptive activity continued, coeval with deposition of the fully marine black shale and silty, occasionally glauconitic, sandstone beds of the Lower Colorado Group (Joli Fou, Westgate, and Belle Fourche formations). Eruptions during this interval were dominated by subaerial deposits, and resulted in gradational build-up of low, positive-relief, cone-shaped domes over the earlier feeder vents/maars. Distal to the volcanic centers, kimberlite beds (which occur at several horizons) consist of marine airfall deposits that commonly exhibit evidence of wave reworking. Black shale-encased kimberlite beds, deposited as subaqueous debris flows and turbidites are particularly common in the Lower Colorado Group.

Overall, sedimentologic evidence supports the hypothesis that many of the Fort à la Corne kimberlite bodies resulted from a complex eruptive history in a dynamic coastal setting. Physical bedforms and biogenic structures in reworked kimberlite as well as interfingering of primary airfall and reworked kimberlite beds provide strong evidence that multiple eruptions occurred, and appreciable time elapsed between eruptions.

[1] Geological Survey of Canada, 3303 33rd Street NW, Calgary, AB T2L 2A7; E-mail: jzonneve@nrcan.gc.ca.
[2] Geological Survey of Canada, 601 Booth Street, Ottawa, ON K1A 0E8.
[3] Shore Gold, 300 - 224 4th Avenue South, Saskatoon SK S7K 3R3.

D. EXTECH IV Athabasca Basin (full papers available on Summary of Investigations 2002, Volume 2 CD-ROM)

EXTECH IV Athabasca Uranium Multidisciplinary Study: Mid-year 2002-03 Overview and Impact Analysis

C.W. Jefferson[1], *G. Delaney, and R.A. Olson*[2]

Jefferson, C.W., Delaney, G., and Olson, R.A. (2002): EXTECH IV Athabasca uranium multidisciplinary study: Mid-year 2002-03 overview and impact analysis; *in* Summary of Investigations 2002, Volume 2, Saskatchewan Geological Survey, Sask. Industry Resources, Misc. Rep. 2002-4.2, CD-ROM.

Abstract

In the third and final year, EXTECH IV has progressed on 15 sub-projects, evolving from data acquisition to interpretation with a strong focus on integration. Two main goals are being addressed.

1) *The Athabasca Basin geoscience framework is being improved by: a) mapping of Rae-Hearne-Taltson basement domains and their boundaries to simplify and resolve uncertainties; b) mapping open pits to put into regional context and document the predictive relationships of uranium ore to brittle reactivation of previous ductile basement structures; c) quantitative litho-sequence stratigraphy across the six regional deposystems in the Athabasca Basin to resolve east-west inconsistencies and update the regional framework; d) documenting fluvial style, detailed facies relationships, and paleo-valleys associated with ore in open pits and drill camps; e) mineralogical refinement of alteration vectors to ore; f) geochronology studies that have generated detrital zircon U-Pb ages to constrain sequences and provenance and resulted in the development of new SHRIMP standards to date uraninite; g) Quaternary geology and geochemistry is calibrating unusual K-U trends in airborne gamma ray maps; h) high-quality 2D and pseudo-3D seismic images that are extending borehole stratigraphy and structure, tracking the unconformity and its offset by the ore-related P2 reverse fault zone, and identifying a possible mafic intrusion at depth as a possible heat source for hydrothermal ore generation; and i) public domain and new data are being captured and managed in GIS databases.*

2) *New and enhanced EXploration TECHnology (seismic reflection, gravity, magnetotellurics, gamma ray and multiparameter borehole geophysics) are correlating in new ways and calibrating typical ore, host rock, and alteration parameters of the world class McArthur River mining camp as tools to aid exploration within Athabasca Basin and beyond.*

Sustainable economic and social development in northern Saskatchewan and Alberta have been enhanced by improved exploration decision making, new ideas, new land acquisitions, and training of 10 young scientists. New partnerships and new ideas are being developed for potential future projects.

[1] Geological Survey of Canada, 601 Booth Street, Ottawa, ON K1A 0E8; PAS/TGI Project PS1018.
[2] Alberta Geological Survey, 4th Floor, Twin Atria, 4999 - 98 Avenue, Edmonton, AB T6B 2X3.

Seismic Reflection Profiling: An Effective Exploration Tool in the Athabasca Basin? An Interim Assessment

D.J. White [1], B. Roberts [1], C. Mueller [1], Z. Hajnal [2], I. Gyorfi [2], B. Reilkoff [2], R. Koch [3], and B. Powell [4]

White, D.J., Roberts, B., Mueller, C., Hajnal, Z., Gyorfi, I., Reilkoff, B., Koch, R., and Powell, B. (2002): Seismic reflection profiling: An effective exploration tool in the Athabasca Basin? An interim assessment; *in* Summary of Investigations 2002, Volume 2, Saskatchewan Geological Survey, Sask. Industry Resources, Misc. Rep. 2002-4.2, CD-ROM.

Abstract

Interim results from the EXTECH IV 2000 high-resolution seismic reflection program at the McArthur River mine site are presented and assessed in light of the original objectives that were set for this program. General observations from 2D high-resolution profile 12 include:

1) *A prominent reflector of unknown origin at ~120 m depth within the sedimentary column with <50 m of relief over its ~1.5 km lateral extent.*
2) *A prominent reflector at ~400 to 600 m depth with relief of up to 120 m (both paleotopography and/or syn-post sedimentation faulting) which is tentatively interpreted as a well-developed regolith at the basement unconformity.*
3) *Laterally limited subhorizontal reflections between these prominent reflections that may represent lateral variations in the physical properties of the sediments.*
4) *Angular disconformities within the sedimentary column.*
5) *Reverse faults along the interpreted unconformity including the P2 fault.*
6) *A reflection response from the location of the orebody.*
7) *Basement reflections with estimated true dips of ~40 to 45°SE.*

Simulated seismic responses for a model of the orebody indicate that: 1) diffractions are produced by both the orebody and the hosting (or bounding) fault zone; 2) the orebody diffraction has higher amplitudes down-dip; 3) horizontal component geophones may provided enhanced detection of the steeply dipping ore zones, and 4) the characteristic diffraction response is observed on the unmigrated section. Preliminary results from the pseudo-3D survey show reflections at the depth corresponding to the unconformity as interpreted on the 2D profiles.

[1] Continental Geoscience Division, Geological Survey Of Canada, 615 Booth Street. Ottawa, ON K1A 0E9.
[2] Dept. of Geological Sciences, University of Saskatchewan, Saskatoon, SK S7N 5E2.
[3] COGEMA Resources Inc., 817 – 45th Street West, Saskatoon, SK S7K 3X5.
[4] Cameco Corp., 2121 11th Street West, Saskatoon, SK S7M 1J3.

Initial Seismic Images Along Line 14 of the McArthur River High-resolution Survey

I. Gyorfi [1], Z. Hajnal [1], S. Bernier [2], E. Takacs [1], B. Reilkoff [1], D. White [3], B. Powell [4], and R. Koch [5]

Gyorfi, I., Hajnal, Z., Bernier, S., Takacs, E., Reilkoff, B., White, D., Powell, B., and Koch, R. (2002): Initial seismic images along line 14 of the McArthur River high-resolution survey; *in* Summary of Investigations 2002, Volume 2, Saskatchewan Geological Survey, Sask. Industry Resources, Misc. Rep., 2002-4.2., CD-ROM.

Abstract

The super high-grade, unconformity-related McArthur River uranium deposit is situated in the east-central Athabasca Basin of northern Saskatchewan and Alberta. It is the largest known and highest-grade uranium deposit in the world. To better constrain the geological framework of the ore bodies and to test the functionality of the seismic reflection method in this specific environment, two high-resolution profiles were acquired within the frame of the EXTECH IV Athabasca Uranium Multidisciplinary Study. Earlier studies and field records of high-resolution line 14 already suggested that the study area exhibits very complex internal architecture. This initial report is based on further processing of the data to eliminate both coherent and random noise that reduced the quality of the seismic images. Preliminary pattern analysis of these improved images generally accords with and extends previous geological models between drill-hole data sets. The unconformity between Archean and Paleoproterozoic gneisses of the Hearne Province and the overlying Athabasca Group sandstones, and its offset by the P2 and other complex faults, are clearly visible in the new seismic images. In addition, the disturbance caused by the P2 fault zone extends into the overlying Athabasca Group sandstones. The P2 and related faults are reactivations of earlier structures in the metamorphic basement.. The observed details clearly demonstrate the applicability of seismic methods to improve the geological framework for uranium exploration, as well as to directly image ore-related structures.

[1] Dept. of Geological Sciences, University of Saskatchewan, Saskatoon, SK S7N 5E2.
[2] Laurentian University, Dept. of Earth Sciences, Sudbury, ON P3E 2C6.
[3] Continental Geoscience Division, Geological Survey of Canada, 615 Booth Street., Ottawa, ON K1A 0E9.
[4] Cameco Corp., 2121 11th Street West, Saskatoon, SK S7M 1J3.
[5] COGEMA Resources Inc., 817-825 45th Street West, Saskatoon, SK S7L 5X2.

Regional Seismic Images Beneath the McArthur River Ore Bodies, Saskatchewan

Z. Hajnal [1], E. Takacs [1], D. White [2], B. Reilkoff [1], B. Powell [3], and R. Koch [4]

Hajnal, Z., Takacs, E., White, D., Reilkoff, B., Powell, B., and Koch, R. (2002): Regional seismic images beneath the McArthur River ore bodies, Saskatchewan; *in* Summary of Investigations 2002, Volume 2, Saskatchewan Geological Survey, Sask. Industry Resources, Misc. Rep. 2002-4.2, CD-ROM.

Abstract

Two subparallel, regional seismic reflection profiles of the multidisciplinary and multi-institutional EXTECH-IV project outline fundamental relationships between the local structures of the McArthur River uranium mine of the Mesoproterozoic Athabasca Basin and the underlying deep crustal tectonic framework. This deep reflection sounding investigation crosses over the P2 ore body, which is located in the region of a magnetic low. Tomographic inversion of the first-break arrival times indicated lateral changes in P-wave velocities of the sandstone along the survey lines. Distinct high-velocity zones mark alteration of the sandstone over known mineralized zones in the P2 ore body.

The migrated time sections are characterized by robust reflection signals from near surface to past-Moho depths. The sandstone-basement unconformity is clearly imaged, however, its correlation is more difficult along the central and southern part of the profiles due to influences of major structural disturbances. The differing patterns of reflections observed along the profiles will potentially allow distinction of the Wollaston/Mudjatik Transition Zone from the Wollaston Domain. South dipping reflections are traceable to a 4 km depth in the crust and are correlated with the P2 reverse fault that hosts the P2 ore bodies of the McArthur mine. The P2 structure is over 2.5 km thick and its seismic signature suggests multi-phase deformation. Strong, arcuate, and in places subparallel, zones of reflectivity dominate the middle and lower crust. The origin of these prominent seismic events appears to be located at the southern margin of the seismic investigation.

Highly prominent, bright and sub-horizontal reflections, at 2.3 s two-way time (TWT), are the most distinct seismic signatures on the sections. These events are directly comparable to reflections observed along the northern half of the 1994 LITHOPROBE regional line S2B. The origin of this enigmatic zone of reflectivity is still under considerable discussion; this zone in 1994 data has been associated with the post-Hudsonian Mackenzie Igneous Event (1.265 Ga). The Moho is well defined at about 10.5 s TWT and is characterized by a number of laterally recognizable gently south-dipping reflections. Below the Moho, a zone of strong reflectivity delineates the upper mantle, revealing considerable tectonic involvement of the lithospheric mantle within the depth range of 35 to 45 km. A gentle southeastern dip in the tectonic development of the region symbolizes the overall structural attitude of this highly reflective zone.

[1]Dept. of Geological Sciences, University of Saskatchewan, Saskatoon, SK S7N 5E2.
[2]Continental Geoscience Division, Geological Survey of Canada, 615 Booth Street, Ottawa, ON K1A 0E9.
[3]Cameco Corp., 2121 11th Street West, Saskatoon, SK S7M 1J3.
[4]COGEMA Resources Inc., 817-825 45th Street West, Saskatoon, SK S7L 5X2.

Borehole Geophysical Logging of Two Deep Surface Boreholes and One Underground Borehole at McArthur River

C.J. Mwenifumbo [1], B.E. Elliott [1], G. Drever [2], and G. Wood [2]

Mwenifumbo, C.J., Elliott, B.E., Drever, G., and Wood, G. (2002): Borehole geophysical logging of two deep surface boreholes and one underground borehole at McArthur River; *in* Summary of Investigations 2002, Volume 2, Saskatchewan Geological Survey, Sask. Industry Resources, Misc. Rep. 2002-4.2, CD-ROM.

Abstract

Multi-sensor geophysical measurements including spectrometric natural γ-ray, spectral γ-γ density, full waveform sonic, resistivity, and temperature were made in two deep drill holes at McArthur River. The main objective was to expand our understanding of the geophysical characteristics of the basement rocks underlying the Athabasca Basin and to aid in the interpretation of surface high-resolution seismic and electrical survey data. There are significant differences in the physical rock properties between the basement rocks and the overlying sandstones that accurately define the sandstone/basement contact where there is minor alteration. Logging underground in the uranium ore zone indicates that uranium ore exhibits low velocities (<5 km/s) compared to the altered gneisses.

[1] Geological Survey of Canada, 601 Booth Street, Ottawa, ON K1A 0E8.
[2] Cameco Corporation 2121 11th Street West, Saskatoon, SK S7M 1J3.

Post-mineralization Origin of Organic Matter in Athabasca Unconformity Uranium Deposits, Saskatchewan

N.S.F. Wilson [1], L.D. Stasiuk [1], and M.G. Fowler [1]

Wilson, N.S.F., Stasiuk, L.D., and Fowler, M.G. (2002): Post-mineralization origin of organic matter in Athabasca unconformity uranium deposits; *in* Summary of Investigations 2002, Volume 2, Saskatchewan Geological Survey, Sask. Industry Resources, Misc. Rep. 2002-4.2, CD-ROM.

Abstract

The EXTECH IV Sub-project 3 in the Athabasca Basin, Saskatchewan, aimed to evaluate: 1) the origins of pyrobitumens, bitumens, and hydrocarbons associated with uranium mineralization; 2) the role and/or influence of bitumens and hydrocarbons on uranium mineralization; and 3) the possibility of a Proterozoic petroleum (including source rock, petroleum migration, and petroleum reservoirs). In this paper we present petrographic, paragenetic, and thermal maturity data for pyrobitumens associated with mineralization and for bitumens distal to mineralization. The main conclusions thus far indicate.

1) *That all pyrobitumen was introduced (i.e., as petroleum) after mineralization, cross-cuts uranium mineralization, and consequently had no role in mineralization. Additionally, the presence of pyrobitumen does not indicate proximity to mineralization.*
2) *Similar paragenetic relationships between pyrobitumen associated with uranium mineralization from different deposits suggests that the pyrobitumen was probably was derived from similar source materials and had a similar emplacement history.*
3) *Reflectance data supports the paragenetic data and differentiates between older pyrobitumen (anisotropic with variable reflectance between ~1 to 2.6%) and younger regional bitumens identified within Athabasca Group sandstone (<0.8%Ro).*
4) *That low-maturity regional bitumens in sandstones are not Proterozoic in age and were most likely derived from Phanerozoic crude oils which likely migrated during late Cretaceous to Early Tertiary times, and subsequently degraded to a higher molecular weight product.*

[1] Geological Survey of Canada Calgary, 3303-33rd Street NW, Calgary, AB T2L 2A7.

A Preliminary Comparison of Manitou Falls Formation Stratigraphy in Four Athabasca Basin Deposystems

G. Yeo, C.W. Jefferson [1], and P. Ramaekers [2]

Yeo, G., Jefferson, C.W., and Ramaekers, P. (2002): A preliminary comparison of Manitou Falls Formation stratigraphy in four Athabasca Basin deposystems; *in* Summary of Investigations 2002, Volume 2, Saskatchewan Geological Survey, Sask. Industry Resources, Misc. Rep. 2002-4.2 CD-ROM.

Abstract

The stratigraphy of the Manitou Falls Formation is remarkably consistent among the three deposystems in the northern, eastern, and southern parts of the late Paleoproterozoic Athabasca Basin. The Athabasca deposystems were originally defined on the basis of paleocurrent patterns, prior to development of the basin stratigraphy. They are here re-defined as unconformity-bounded sedimentary tongues with a consistent sediment dispersal pattern and lithostratigraphy. The Moosonees, Ahenakew, and Karras deposystems comprise only Manitou Falls strata, and the latter deposystem is now extended westward to include Manitou Falls strata formerly included in the Bourassa deposystem. Four lithostratigraphic members are recognized in each deposystem. The MFa member comprises conglomerate and sandstone with distinctive low-angle cross-lamination. The upper MFa sandstone appears to be traceable across the basin. The MFb member is distinguished by conglomerate beds >2 cm thick. It is widespread, except in western Karras deposystem. The MFc member is a relatively clean sandstone with scattered pebbles. Anomalous local thickening of this member in all three deposystems suggests syndepositional basin subsidence. The MFd member is characterized by relatively abundant (>1%) clay intraclasts, which become less common to the west. An MFc-like, pebbly sandstone sub-unit is common in the lower part of this member throughout much of the basin, but dies out to the west. The lower and upper contacts of the formation are regional unconformities, and hence, sequence boundaries. The MFa-MFb contact is a local unconformity, but more work is needed to demonstrate that it is a regional one.

[1] Geological Survey of Canada, 601 Booth Street, Ottawa, ON K1A 0E8.
[2] MF Resources, 832 Parkwood Drive SE, Calgary, AB T2J 3W7.

Stratigraphy of the Manitou Falls Formation Along the McArthur River High-resolution Seismic Survey B-B', Athabasca Basin, Saskatchewan

Sébastien Bernier [1]

Bernier, Sébastien (2002): Statigraphy of the Manitou Falls Formation along the McArthur River high-resolution seismic survey B-B', Athabasca Basin, Saskatchewan; *in* Summary of Investigations 2002, Volume 2, Saskatchewan Geological Survey, Sask. Industry Resources, Misc Rep. 2002-4.2, CD-ROM.

Abstract

During this last season of fieldwork of a M.Sc. project in sedimentology and stratigraphy done at the McArthur River mine site, three boreholes were logged or relogged (i.e., MAC-198, MAC-218 (relogged) and RL-064). Acquisition of new data and testing the actual definition of the different sub-units done on these cores permits the development of an updated stratigraphic cross-section along the high-resolution seismic survey line B-B'. Detailed sedimentology on specific intervals on RL-046 allows the recognition of a sequence boundary (disconformity) between the sub-units MFa4 and MFb1 of the Manitou Falls Formation. Future analysis will permit the development of a systematic description of the different sub-units.

[1] Department of Earth Sciences, Laurentian University, 935 Ramsey Lake Road, Sudbury, ON P3E 2C6; E-mail: bernierjolette@sympatico.ca.

Clay Oncoids and Crypto-microbial Laminites from the Late Paleoproterozoic Manitou Falls Formation, Athabasca Basin, Saskatchewan

Gary Yeo, Jeanne B. Percival [1], Charles W. Jefferson [1], Sébastien Bernier [2], and Pat Hunt [1]

Yeo, G., Percival, J.B., Jefferson, C.W., Bernier, S., and Hunt, P. (2002): Clay oncoids and crypto-microbial laminates from the late Paleoproterozoic Manitou Falls Formation, Athabasca Basin, Saskatchewan; *in* Summary of Investigations 2002, Volume 2, Saskatchewan Geological Survey, Sask. Industry Resources, Misc. Rep., 2002-4.2, CD-ROM.

Abstract

Bean-sized, laminated structures from basal Manitou Falls strata near Hook Lake in the Athabasca Basin are re-interpreted to be clay oncoids which grew in ephemeral pools or lakes in a flashy river system. Comparable micro-laminated structures in microcrystalline quartz from the McArthur River area are also of probable microbial origin. These structures add to a growing body of evidence for life in Proterozoic non-marine environments and contribute to our understanding of regional paleo-environments in early Manitou Falls time.

[1] Geological Survey of Canada, 601 Booth Street, Ottawa, ON K1A 0E8.
[2] Department of Earth Sciences, Laurentian University, 935 Ramsey Lake Road, Sudbury, ON P3E 2C6.

Detailed Stratigraphy and Facies Analysis of the Paleoproterozoic Athabasca Group along the Shea Creek–Douglas River Transect, Northern Saskatchewan

Brent Collier [1]

Collier, B. (2002): Detailed stratigraphy and facies analysis of the Paleoproterozoic Athabasca Group along the Shea Creek–Douglas River transect, northern Saskatchewan; *in* Summary of Investigations 2002, Volume 2, Saskatchewan Geological Survey, Sask. Industry Resources, Misc. Rep. 2002-4.2, CD-ROM.

Abstract

Five third order sequences have been identified in twelve drill cores along the Shea Creek–Douglas River transect south of the Carswell structure in the western Athabasca Basin. In ascending order these are: "Shea Creek", "Lower Manitou Falls", "Upper Manitou Falls", Lazenby Lake–Wolverine Point, and Locker Lake sequences. Sequence boundaries have been chosen on the basis of grain size and sedimentary structures. Sharp unconformable contacts are only observed at the Manitou Falls–Lazenby Lake boundary, where possible biofilm indicators suggest a hiatus in sedimentation. Elsewhere, sequence boundaries appear conformable or are difficult to distinguish from local erosional discontinuities. In these cases, sequences and their respective depositional environments are defined on the basis of sedimentary structures. The lowest sequence in the Athabasca Group, the "Shea Creek sequence", has not previously been distinguished from the overlying Manitou Falls Formation. It is differentiated from the latter on the basis of primary sedimentary structures. Features such as larger scale trough and planar cross-stratified bed forms suggest deposition from perennial braided streams. Low-angle cross- and flat-laminated units suggest flash floods. Inversely graded pinstripe lamination, and possible impact ripples may indicate thin-bedded aeolianites. Their preservation supports a relatively humid setting and a high water table. The better sorting of the "Shea Creek sequence" sandstones resulted in greater permeability than the overlying semi-perennial to ephemeral river deposits. As a result, these sandstones, especially the flat-bedded units, could have acted as preferred conduits for fluid flow along the basal unconformity. Up to 25% flat-laminated and low-angle inclined sandstone beds in the "Lower Manitou Falls" suggest an ephemeral to "flashy" fluvial system. Absence of these types of sandstones near the base of the "Upper Manitou Falls 1" sub-member suggests a semi-perennial or perennial system, but they reappear as low frequency interbeds in the "Upper Manitou Falls 2" sub-member and gradually increase to 10% toward the Lazenby Lake contact, indicating a return to more ephemeral stream conditions. The Lazenby Lake–Locker Lake succession represents a more mud-rich system, with twenty times more fine sediment interbeds than in the Manitou Falls Formation. Up to 20% convoluted/overturned bedding at all levels throughout the Lazenby Lake–Locker Lake succession may be a result of frictional drag in a high-energy flow regime. These strata were deposited in a semi-perennial fluvial system.

[1] Department of Earth Sciences, Laurentian University, 935 Ramsey Lake Road, Sudbury, ON P3E 2C6; E-mail: bn_collier@nickel.laurentian.ca

Preliminary Results From a Study of the Geology and Alteration at the Maybelle River Uranium Zone, Athabasca Basin, Alberta, EXTECH IV

Barbara G. Kupsch [1] *and Octavian Catuneanu* [1]

Kupsch, B.G. and Catuneanu, O. (2002): Preliminary results from a study of the geology and alteration at the Maybelle River uranium zone, Athabasca Basin, Alberta, EXTECH IV; *in* Summary of Investigations 2002, Volume 2, Saskatchewan Geological Survey, Sask. Industry Resources, Misc. Rep. 2002-4.2, CD-ROM.

Abstract

A detailed study of 15 drill cores surrounding the uranium zone in the Maybelle River area, in the southwestern part of the Athabasca Basin in Alberta, was undertaken to better define Athabasca Group sedimentology, stratigraphy, and alteration surrounding the deposit. The Athabasca Basin comprises the Fair Point, Manitou Falls, and the base of the Lazenby Lake formations; the basement consists of granitoid gneisses, graphitic mylonites and mylonites. An alteration halo surrounding the uranium zone is similar in characteristic to that associated with deposits in Saskatchewan. Massive clay replacement, quartz dissolution and sandstone collapse, drusy quartz and pyrite lined fractures, chlorite overprinting, and bleaching of core occur in the holes surrounding the uranium zone.

[1] Department of Earth and Atmospheric Sciences, University of Alberta, 1-26 Earth Sciences Building, Edmonton, AB T6G 2E3.

New Investigations of Basement to the Western Athabasca Basin

Colin Card

Card, C.D. (2002): New investigations of basement to the western Athabasca Basin; *in* Summary of Investigations 2002, Volume 2, Saskatchewan Geological Survey, Sask. Industry Resources, Misc. Rep. 2002-4.2 CD-ROM.

Abstract

In 2002, investigations of basement to the western Athabasca Basin included reconnaissance outcrop mapping in the Careen Lake area of the Lloyd and Virgin River domains, the Clearwater Domain along the Clearwater River, and the Pine Channel/Fond-du-Lac areas of the Tantato Domain. In addition, diamond drill core was examined from the Dufferin, Carswell, and Hocking lakes areas. The Lloyd Domain contains granulite facies rocks including an old supracrustal package, the Careen Lake Group, that was intruded by ultramafic rocks and a poly-deformed quartz diorite suite. The Virgin River Domain contains dominantly high-grade felsic gneiss and a sliver of middle amphibolite facies supracrustal rocks, the Virgin Schist Group. Younger, less-deformed mafic dykes and granitoid rocks intrude the gneisses, including the equigranular and K-feldspar-phyric Clearwater granites of the Clearwater Domain.

The Lloyd Domain contains an old flat-lying S_1 foliation which is folded about nearly upright northeast-trending F_2 folds. The D_3 age Virgin River Shear Zone was subjected to multiple episodes of displacement. An old east-verging reverse shear zone was overprinted by at least two episodes of dextral shearing. West-northwest- to northwest-trending F_4 folds probably formed under the same stress regime responsible for late sinistral brittle-ductile displacement along the Virgin River Shear Zone. Evidence for reverse, post-Athabasca Group faulting was observed in drill core at Dufferin Lake. Most rocks in the Lloyd Domain have been subjected to two phases of high-grade metamorphism: the first reaching granulite facies as indicated by orthopyroxene-bearing diatexites and the second at least upper amphibolite facies.

The Tantato Domain is divided into upper and lower structural decks. The upper deck is dominated by high-grade supracrustal rocks and the lower deck by mylonitic rocks of plutonic origin. Most of the rocks were strongly sheared during D_2 deformation which transposed a pre-existing S_0/S_1 composite foliation. The D_2 mylonites were folded about northeast-trending F_3 axial planes and again, about east-northeast trending F_4 axial planes. Brittle reactivation of the ductile zone was episodic. Two phases of granulite facies metamorphism affected the Tantato Domain, but it is unclear which event was responsible for the unusually high pressures of at least 10 kbars and rarely >15 kbars.

The Clearwater Magnetic High, which overprints magnetic trends of the Lloyd Domain is presumed to be underlain by the Clearwater granites, although the granites are apparently magnetite poor. Magnetite crystallized during interaction of different granite phases in the batholith-scale intrusion and is commonly found along contacts and at the contacts of xenoliths of older gneiss. The Virgin Schist Group is a tectonically bound sliver of anomalously low-grade supracrustal rocks that was either down-dropped during early, east-verging thrusting or deposited subsequent to reverse shear but prior to later dextral shear along the Virgin River Shear Zone. Supracrustal rocks of the Tantato Domain are likely equivalent to the Careen Lake Group of the Lloyd Domain, however, the rocks that underlie the main magnetic highs in the two domains are dissimilar.

Integrated Field Investigations of Airborne Radiometric Spectral Domains, NEA–IAEA Test Area, Eastern Athabasca Basin: A Preliminary Report

J.E. Campbell, R.B.K. Shives [1], and R.A. Klassen [1]

Campbell, J.E., Shives, R.B.K., and Klassen, R.A. (2002): Integrated field investigations of airborne radiometric spectral domains, NEA–IAEA test area, eastern Athabasca Basin: A preliminary report; *in* Summary of Investigations 2002, Volume 2, Saskatchewan Geological Survey, Sask. Industry Resources, Misc. Rep. 2002-4.2, CD-ROM.

Abstract

In the NEA–IAEA test area, eastern Athabasca Basin, prominent patterns in airborne gamma ray spectral signatures have been used to define spectral domains. In part, the domains reflect variation in the proportions of intra- and extra-basinal glacial detritus. Several spectral domains are of interest: the eTh-rich domains, the K-rich northwest corner, and a narrow, southwest-trending curvilinear K- and eU-rich "ribbon". The narrow, curvilinear ribbon has previously been modeled as a dispersal train of granitic boulders, and as the surface expression of local bedrock alteration. To better understand the significance of these domains, cooperative field studies including ground spectrometry, Quaternary geology, and till geochemistry were carried out during the summer of 2002 as part of EXTECH IV. Different surficial materials (e.g., bedrock, boulders, till) were measured by ground spectrometry, and till was sampled for geochemical analyses and provenance determination.

Preliminary interpretation of data indicates ground spectrometric values are consistent with airborne data. Till composition and provenance vary across the area, and vertically within glacial deposits, reflecting glacial history. For till, no correlations between geochemistry (<0.063 mm) and ground spectrometric values are apparent, likely reflecting compositional differences between the size fractions measured by the two methods. Interpretation of till geochemistry in terms of mineralogy provides a potentially useful approach to geochemical exploration.

The eTh–rich A domain spectral signatures reflects a sandstone source, either from sandstone-rich till or exposed sandstone bedrock. The K-rich northwest corner is part of a regional glacial dispersal train of crystalline detritus extending across the eastern Athabasca Basin. Preliminary work suggests that the ribbon domain spectral patterns may reflect a multi-genetic Quaternary feature derived from multiple sources. Further work is required to resolve the genesis of the ribbon spectral trend.

[1] Geological Survey of Canada, 601 Booth Street, Ottawa, ON K1A 0E8.

Mineralogical Aspects of Three Drill Cores Along the McArthur River Transect Using a Portable Infrared Spectrometer

J.B. Percival [1], K. Wasyliuk [2], T. Reif [3], S. Bernier [4], G. Drever [2], and C.T. Perkins [2]

Percival, J.B., Wasyliuk, K., Reif, T., Bernier, S., Drever, G., and Perkins, C.T. (2002): Mineralogical aspects of three drill cores along the McArthur River transect using a portable infrared spectrometer; *in* Summary of Investigations 2002, Volume 2, Saskatchewan Geological Survey, Sask. Industry Resources, Misc. Rep., 2002-4.2, CD-ROM.

Abstract

Detailed logging and infrared analyses of samples from three drill cores were completed during field activities in 2002 at the McArthur River mine site in northern Saskatchewan. Both FieldSpec Pro and PIMA-II portable spectrometers were used to determine mineralogy of the matrix in representative samples selected every 1.5 m. Spectral data from the FieldSpec Pro were converted to PIMA format and processed using the MINSPEC algorithm for semi-quantitative mineral analysis. Results for the three cores are highly comparable, although a separate algorithm is needed for processing FieldSpec Pro spectra.

Mineralogy distribution in each core is similar. The upper MFa and MFb members of the Manitou Falls Formation contain abundant kaolinite with subordinate dravite and chlorite. Illite is present in variable amounts. There is a sharp increase in illite content at the base of MFb. From there, illite gradually decreases to the unconformity as dickite concomitantly increases. The preservation of dickite, the regional diagenetic clay mineral, is due to intense silicification in MFc and MFd. Alteration minerals in basement rocks include chlorite and illite with minor kaolinite and dravite. Illite and chlorite reflect circulating hydrothermal fluids and dravite has been ascribed to mineralizing fluids. The clay mineral distributions are controlled by parameters such as porosity, permeability, fluid pressures as well as fluid chemistry and follow lithological variations in the Manitou Falls Formation.

[1] Geological Survey of Canada, 601 Booth Street, Ottawa, ON K1A 0E8; E-mail: jperciva@nrcan.gc.ca.
[2] Cameco Corporation, 2121 11th Street West, Saskatoon, SK S7M 1J3.
[3] Office of Minerals and Energy Resources South Australia, 101 Grenfell Street, Adelaide, SA 5001.
[4] Department of Earth Sciences, Laurentian University, Ramsey Lake Road, Sudbury, ON P3E 2C6.

EXTECH IV Sub-project 9T: A 3D Audio-Magnetotelluric Survey at the McArthur River Mining Camp

J.A. Craven [1], G. McNeice [2], B. Powell [3], R. Koch [4], I.R. Annesley [5], G. Wood [3], and J. Mwenifumbo [6]

Craven, J.A., McNeice, G., Powell, B., Koch, R., Annesley, I.R., Wood, G., and Mwenifumbo, J. (2002): EXTECH IV Sub-project 9T: A 3D audio-magnetotelluric survey at the McArthur River Mining Camp; *in* Summary of Investigations 2002, Volume 2, Saskatchewan Geological Survey, Sask. Industry Resources, Misc. Rep. 2002-4.2, CD-ROM.

Abstract

A 3D audio-magnetotelluric (AMT) survey was conducted in the McArthur River uranium mining camp, northern Saskatchewan. The AMT data were acquired to provide a 3D view into the subsurface conductivity structure of the McArthur deposit, the overlying Athabasca Group Sandstones, the basement lithologies and offsets, and the alteration assemblages associated with the deposit. In total, 135 AMT sites were acquired along eleven profiles over the P2 and P2 North mineralized zones with an average site spacing of 300 m.

[1] Geological Survey of Canada, 615 Booth Street, Ottawa, ON K1A 0E9.
[2] Geosystem Canada, 560 Raftsman Lane, Ottawa, ON K1C 2V3.
[3] Cameco Corporation, 2121 - 11th Street West, Saskatoon, SK S7M 1J3.
[4] COGEMA Resources Inc., 817 - 45th Street West, Saskatoon, SK S7K 3X5.
[5] Saskatchewan Research Council, 15 Innovation Boulevard, Saskatoon, SK S7N 2X8.
[6] Geological Survey of Canada, 601 Booth Street, Ottawa, ON K1A 0E8.

Modelling of High-resolution Gravity Data Near the McArthur River Uranium Deposit, Athabasca Basin

G. Wood [1] and M.D. Thomas [2]

Wood, G. and Thomas, M.D. (2002): Modelling of high-resolution gravity data near the McArthur River uranium deposit, Athabasca Basin; *in* Summary of Investigations 2002, Volume 2, Saskatchewan Geological Survey, Sask. Industry Resources, Misc. Rep. 2002-4.2, CD-ROM.

Abstract

Preliminary modelling of gravity data collected at 50 or 100 m station-spacing along a 27.2 km traverse near the unconformity-associated McArthur River uranium deposit, Athabasca Basin has been completed. The range of terrain-corrected Bouguer anomalies (reduction density = 2.00 g/cm^3) in a derived gravity profile is approximately 2.9 mGal. A relatively long wavelength gravity high (>2500 m wide, +1.75 mGal amplitude) and low (6000 m to 1.15 mGal) dominate the southern part of the profile. The northern part is characterized by less extreme variations in gravity, and most anomalies have smaller wavelengths and amplitudes, generally about 500 m (or less) and <0.5 mGal, respectively. Several others have longer wavelengths (up to ~1800 m), but similar amplitudes. A conspicuous 3000 m wide, 1 mGal amplitude positive anomaly occurs at the northern end of the profile. Modelling of anomalies is constrained by magnetic data, drill-hole logs and density information, and reflection seismic data. Long wavelength anomalies are attributed to variations in basement density and offset of the basement unconformity, the principal high being modelled in terms of a quartzite ridge. The shortest wavelength anomalies are explained by variations in overburden thickness, support for which is provided by drill holes. Thickened overburden may be indicative of faulting within the sandstone, which is locally weakened and more susceptible to glacial scouring. Intermediate wavelength anomalies are explained by alteration within the Athabasca Sandstone, manifested as relatively high density sandstone silicification, particularly above quartzite ridges. Desilicification is present, but limited. Identification of such alteration zones is critical to uranium exploration, since they are associated with mineralizing fluids, and because silicification/desilicification patterns are important to exploration from a fluid flow perspective.

[1] Cameco Corporation, 2121- 11th Street West, Saskatoon, SK S7M 1J3.
[2] Geological Survey of Canada, 615 Booth Street, Ottawa, ON K1A 0E9.

Summary of Detrital Zircon Geochronology of the Athabasca Group, Northern Saskatchewan and Alberta

R.H. Rainbird [1], *R.A. Stern* [1], *and C.W. Jefferson* [1]

Rainbird, R.H., Stern, R.A., and Jefferson, C.W. (2002): Summary of detrital zircon geochronology of the Athabasca Group, northern Saskatchewan and Alberta; *in* Summary of Investigations 2002, Volume 2, Saskatchewan Geological Survey, Sask. Industry Resources, Misc. Rep. 2002-4.2, CD-ROM.

Abstract

Five sandstone samples representing four formations and five deposystems from the Athabasca Group have been processed for some 300 detrital zircons that were analysed individually in the Geological Survey of Canada's (GSC) SHRIMP laboratory. The following interpretations refer only to detrital zircons that are assumed to represent four formations within specific deposystems. The Fair Point Formation (Fidler Deposystem) is dominated by Neoarchean zircons with a main peak at 2.6 Ga, a secondary peak at 1.9 Ga, and suggested provenance from the Taltson magmatic zone and western Rae Province. The Manitou Falls Formation member MFb in the Ahenakew Deposystem also shows a pronounced bimodal age distribution with modes at 2.5 Ga and 1.85 Ga and suggested provenance from the Hearne Province and Trans-Hudson orogen respectively, consistent with easterly paleocurrents that characterize the Ahenekew Deposystem. The Manitou Falls Formation member MFd in the Moosonees Deposysytem is characteristic of the Trans-Hudson Orogen with a mode at 1.83 Ga. The sample from the Wolverine Point Formation in the Bourassa Deposystem contains zircons with ages similar to the Fair Point Formation, including a broad mode spanning 2.7 to 2.5 Ga and a pronounced mode spanning 1.88 to 1.78 Ga, reflecting a more southerly provenance from the western Churchill Province. A significantly younger population of detrital zircons (four grains) ca. 1.66 Ga places an important maximum age constraint on the upper part of the Athabasca Group. The spectrum of the stratigraphically highest sample, from the Douglas Formation (McLeod Deposystem), emulates that of the Wolverine Point Formation, supporting common provenance and the idea that both formations are part of the same deposystem. Zircons observed both petrographically (in-situ), and after separation for analysis, show normal ranges of morphology and preservation. There is no textural evidence in the detrital zircons of systematic regional dissolution, unusual extents of alteration, or unusually high uranium contents.

[1] Geological Survey of Canada, 601 Booth Street, Ottawa, ON K1A 0E8.

E. Open House Talk Abstracts

Cree Extension Project Update – Basement-hosted Uranium Targets Under Deep Sandstone, Ingredients for Success

Charles Roy [1], John Halaburda [1], Darcy Hirsekorn[1], and David Thomas[1]

Abstract

The Cree Extension project is situated in the eastern Athabasca Basin about 35 km north of Key Lake. The project is a uranium exploration joint venture among Cameco Corporation (operator), JCU (Canada) Exploration Company Ltd., UEM Inc., and COGEMA Resources Inc. The property comprises 12 mineral dispositions totaling 12 777 ha.

The project lies at or near to the boundary between the Wollaston and Mudjatik lithostructural domains. The thickness of Athabasca Group sandstones ranges from 500 to 800 m. The project has seen intermittent exploration by several different operators for nearly 25 years. Four main "corridors" or prospective trends have been established by diamond drilling. Exploration results identified the western-most B_1 trend as highly prospective. The southern 10 km of this trend contains a weak but significant U+B anomaly in the sandstone.

Diamond drill hole CX-38, drilled by Uranerz Exploration and Mining Ltd. in the summer of 1998 to test the southern portion of the B_1 conductor, encountered strong argillic alteration and associated anomalous radioactivity 100 m below the unconformity. Cameco became project operator following the acquisition of Uranerz in the fall of 1998. In the winter of 2000, the first follow-up drill hole CX-40 intersected a wide zone of low-grade uranium mineralization, with the best continuous interval grading 1% U_3O_8 over 29 m. Drilling continued in 2001 and 2002 with several significant ore-grade intercepts encountered. All mineralization occurs in the basement and is hosted by metasedimentary and pegmatitic lithologies. The mineralization occurs as massive replacement along foliation planes, as irregular disseminations throughout the rock, as irregular fracture control infillings, as irregular redox-controlled veinlets, and as breccia infill. The argillic alteration attendant to the uranium mineralization displays a zoned association between dravite, chlorite, and sericite. This mineralization has been defined by nine diamond drill-hole intersections, extends over a vertical depth of >100 m, and has been traced along strike for nearly 150 m. A significant drilling program has been proposed for 2003.

Despite being a deep exploration target, a number of features are present to help guide exploration activity and increase the odds of success. First and foremost is the presence of graphitic pelitic lithologies and an associated moderate strength electromagnetic conductor that can be traced for >20 km. The uranium mineralization intersected to date occurs in the footwall of these conductive lithologies. A reverse fault has been interpreted along the B_1 trend with potentially Archean rocks thrust over lower Aphebian metasediments. The extensive and intense argillic basement alteration adjacent to mineralization supports the concept of a large hydrothermal system. The anomalous sandstone chemistry (U+B) suggests a high potential for the more classical unconformity-type mineralization is present in the area.

[1] Cameco Corporation, 2121 - 11th Street West, Saskatoon, SK S7M 1J3.

A New Airborne EM Technology for Exploring Shallow Parts of the Athabasca Basin: AEROTEM

Rodney Koch[1] *and David Bingham*[1]

Abstract

Recent advances and technological development in airborne system components, particularly miniaturization of modules, have resulted in commercial availability of a new time-domain helicopter-borne EM system for shallow depths.

AEROTEM is a helicopter time-domain EM system that measures and collects EM data from a UNICOIL rigid transmitter-receiver array. AeroQuest Limited began development of AEROTEM in 1996. A key feature is the rigid mounting of the receiving coil, centrally within the transmitting loop which maximizes the ratio of target-to-host response in conductive environments while achieving the same coupling with ground conductors simultaneously in both coils.

Other features include a triangular current pulse of 1150 µs, at a base frequency of 150 Hz, outputting of 260A into an eight-turn transmitting loop with a diameter of 5 m. This results in a dipole moment of ~40 000 Atm^2*. The multi-coil receiver, consisting of horizontal (x-axis) and vertical (z-axis) component coils, is mounted rigidly at the centre of the 5 m diameter transmitter coil.*

The AEROTEM system was flown by COGEMA Resources Inc. in the Athabasca Basin environment in 2001 over uranium projects known to have shallower depths to the unconformity, notably the Wolly-McClean and Cluff Lake projects.

This presentation provides a system overview and some model aspects used in interpretation of the data with examples of the airborne data that illustrate the system characteristics and the type anomalies encountered in the survey.

[1] COGEMA Resources Inc., P.O. Box 9204, 825 - 45th Street West, Suite 817, Saskatoon, SK S7K 3X5.

The 777 Volcanogenic Massive Sulphide Deposit

Hudson Bay Mining and Smelting Co., Limited[1]

Abstract

Hudson Bay Mining and Smelting Co., Limited (HBM&S), a wholly owned subsidiary of Anglo American plc, has commenced the development of the 777 deposit in Flin Flon, Manitoba. The 777 deposit is located 1 km north, and on the same stratigraphic horizon as the historic Flin Flon mine. The Flin Flon mine produced 62.5 million tonnes of ore with 2.17% Cu, 4.13% Zn, 2.64g/t Au, and 41.49 g/t Ag between 1930 and 1992.

The 777 lenses were intersected by surface and underground diamond drilling in 1994. Resources outlined to date are shown in Table 1.

Table 1 - 777 – Mineable reserve/resource – Jan 01, 2002

Tonnage(in million tonnes)	*Cu (%)*	*Zn (%)*	*Au (g/t)*	*Ag (g/t)*
14.2	*2.53*	*5.09*	*2.14*	*31.51*

The lenses which define the 777 deposit are directly associated with an episode of felsic volcanism within a dominantly basalt volcanic package termed the Amisk Lake Volcanics (1886 to 1904 Ma). At least three generations of intrusive rocks crosscut the sulphide bodies and volcanic rocks within the mine package. The area typically displays mineral assemblages of greenschist metamorphic facies. The host rocks trend towards the north (015° az) and dip towards the east (40° to 50°). The top of the 777 deposit lies 880 m below surface and plunges in a southeast direction (34°/147° az) and has been defined down to 1500 m below surface. A series of north-east-trending faults have been identified within the Callinan and 777 mine workings. These faults control the final geometry of the sulphide lenses.

Three distinct sulphide lenses make up most of 777 resource. The upper lens (#1) is classified as a zinc-rich solid sulphide and is dominated by pyrite-sphalerite-pyrrhotite-chalcopyrite mineralization (banded textures). Footwall to #1 lens, the #2 lens is a massive sulphide (banded textured) with chalcopyrite-pyrrhotite-pyrite-magnetite assemblages. Underlying these two massive sulphide lenses is a semi-conformable stringer zone (#3 lens) which defines the footwall alteration package, and is dominated by chalcopyrite-pyrrhotite-pyrite-magnetite in a chlorite talc biotite sericite schist.

The upper portion of #2 and #3 lenses have been mined since 1998 (through the Callinan Mine infrastructure), producing 302 thousand tonnes at 7.62% Cu, 0.35% Zn, 1.46 g/t Au, and 9.62 g/t Ag. The mine has been designed for 1.0 million tonnes of ore per annum with the capability of increasing production to 1.35 million tonnes without modifications.

[1] Box 1500, Flin Flon, MB R8A 1N9.

A Progress Report on the Regional Land Use Planning Process and the Representative Areas Network Program in Saskatchewan

Murray C. Rogers

Abstract

The Government of Saskatchewan is currently involved in numerous regional integrated land use planning exercises. The planning processes usually only directly involve Crown surface lands. Saskatchewan Environment (SE) initiates and leads the land use plans under their management, mainly in the north. Saskatchewan Agriculture, Food and Rural Revitalization (SAFRR) leads the plans under their management, mainly in the south. The public advisory planning committees that develop the plans consist of representatives of community and stakeholder groups. The mining and/or oil and gas industries are members of the committees on most of the plans. Representatives of the government departments act in advisory and resource capacities. Saskatchewan Industry and Resources (SIR) participates in the development of all of the plans.

Important considerations for industry are potential restrictions on surface access and activities that may result from these processes. These include the selection of Representative Areas Network (RAN) sites, regional zoning on land use, buffers around water bodies, historical, cultural, archeological, and ecological sites, and the establishment of wildlife management areas. Other relevant issues that are commonly discussed include road and trail development and closure, public consultation, compensation, and environmental monitoring of activities.

Six land use plans have been completed and are being implemented. These are the Prince Albert Model Forest (2000), Pasquia-Porcupine (1998), Fur Lakes (1998), Fowler and Murphy Lakes (1997), Manitou Sand Hills (1996), and Great Sand Hills (1991).

There are currently 13 land use plans that are being developed in the province. SE led planning processes include Amisk-Atik, La Ronge, Fort a la Corne Provincial Forest, Buffalo Pound Lake, North-Central, Pinehouse-Dipper, Athabasca Road Corridor, and Nisbet Provincial Forest. SAFRR led plans include Whitehood, RM 488 (Torch River), Bjorkdale, Stove Creek, and Grand Cheviot.

The Government of Saskatchewan, with SE as the lead department, initiated the RAN program in 1996. The RAN is composed of lands and waters selected and designated to represent the natural ecological and biological diversity of the province and managed to retain that diversity. RAN sites act both as reservoirs of biological diversity and benchmarks for comparison with the more heavily used landscape. There are 11 ecoregions in the province to represent. The RAN includes the existing parks and other previously designated lands. Other government departments, including SIR, are actively involved in the RAN selection process, as well as the general public and industry.

A specific process exists for the review of the RAN site proposals by SIR and industry. SIR initially carries out technical reviews of the mineral (and oil and gas) potential of the proposed sites using qualitative mineral resource assessments that are based on compiled geoscience, mineral deposit, and exploration information. The intent is to locate the RAN sites in areas of low assessed mineral potential. Proposals that may be acceptable are forwarded for review and comment to a range of industry organizations, companies, and individuals, including any disposition holders in the region. Public review of RAN site proposals is often done through the land use plans.

Since 1997, 39 sites totaling about 637 000 ha have been formally designated under the RAN program. No sites have been announced in 2002. However three site proposals, Ile-a-la-Crosse (3 740 ha), Caribou Flats (10 642 ha), and Budd Lake (17 924 ha) in the Lac Ile-a-la-Crosse–Lac La Plonge region, have been reviewed and approved by SIR and industry.

A number of proposed sites, some very large, are currently at various stages of review and discussion by SE, SIR, and industry. These include Tazin Lake (NTS 74N), Chappuis-Fontaine lakes (NTS 74O), Misaw Lake (NTS 64M), Pink Lake (NTS 74A), Geikie River (NTS 74A,H), Cree Lake (NTS 74B,G), Firebag Lake (NTS 74F), and Fort a la Corne (NTS 73H). The public will review most of these proposals through land use planning processes. Interim 10 year surface designations, that allow mineral exploration and development, have been established by SE on the proposed Tazin Lake, Chappuis-Fontaine lakes, and Misaw Lake sites until decisions are made on any formal designations.

For more information please contact me or examine my poster display. Detailed handouts are also available at the poster.

The Star Kimberlite – Evolution of a Diamond Project

Jonathan Challis[1]

Abstract

Fort à la Corne, located 60 km east of Prince Albert, is probably one of the only diamondiferous kimberlite fields in the world in which the complete volcanic system has been preserved. The Star kimberlite, situated at the southeastern end of the major kimberlite cluster, predominantly consists of pyroclastic deposits, with an underlying feeder vent containing diatreme facies kimberlite. The pyroclastic kimberlite deposits consist of sub-aerial olivine-rich crystal tuffs and mixed olivine-lapilli tuffs, with subordinate kimberlite breccia. The Star kimberlite is clearly a multi-eruptive body, in which volcanic pulses appear to occur in close succession. Diamond indicator minerals observed in the Star kimberlite include garnet (both peridotitic and eclogitic), as well as abundant ilmenite and phlogopite. Peridotite and eclogite mantle xenoliths are also present as nodules up to 4 cm in size.

On the basis of 36 NQ, HQ, and PQ core holes, and using a cut-off thickness of 30 m, the size of the Star kimberlite has been estimated at over 500 million tonnes, making it one of the largest drill-defined diamondiferous kimberlites in the world. The most spectacular drill hole to date, STAR 020, intersected 539.4 m of kimberlite. Analysis of the upper 311.6 m of kimberlite from STAR 020, as well as the remaining sampled core holes, has produced an average grade of 0.19 carats/tonne for stones larger than 1 mm. In October 2001, a large diameter (24") reverse circulation hole was drilled, producing about 80 tonnes of kimberlite chips, partly to evaluate alternative methods for taking a 25 000 tonne bulk sample. After AMEC E & C completed analysis of both the micro/macro diamond results from all the holes drilled to date, and the alternative methods of recovering such a bulk sample were examined, it was decided to sink a 4.5 m diameter vertical shaft to a depth of approximately 300 m, located approximately 50 m east of STAR 020. The kimberlite will be processed on site using a 10 tonne per hour DMS concentrator that will result in the collection of a parcel of at least 2,000 carats of diamonds for further analysis.

[1] Shore Gold Inc., 300 - 224 4th Avenue South, Saskatoon, SK S7K 5M5.

An Update on the 2002 Exploration of the 140/141 Kimberlite by the Fort à la Corne Joint Venture

A.K. Berryman[1]

Abstract

In December 2001, The Fort à la Corne Joint Venture, which is comprised of De Beers Canada Exploration Inc., Kensington Resources Ltd., Cameco Corporation, and UEM, reported the successful completion of ten large diameter (609 mm) RC drill holes and 16NQ core holes. Nine of these large diameter holes and 14 of the core holes were placed within the 140/141 kimberlite, which has become the focus of recent Joint Venture activities. The core hole geology indicated that the previously designated 140 and 141 kimberlites were actually a single large kimberlite with an aerial extent of 250 ha.

A total of 466 macrodiamonds (greater than 1.5 mm in size) weighing 45.59 cts was recovered from the ten large diameter holes, including a single 3.335 ct stone from the 140/141 body. Although macrodiamond recoveries were limited to a relatively small portion of the kimberlite, it appears that stone distribution is largely controlled by a pyroclastic megagraded bed, which dominates the kimberlite.

During 2002, in response to these results, an additional 23 NQ core holes, and eight large diameter drill holes were successfully completed. The large diameter drilling included five 609 mm holes in the southern portion of the 140/141 body and three 914 mm holes near the centre of the body, primarily for diamond valuation studies.

[1] Project Manager, De Beers Canada Exploration Inc., 1 William Morgan Drive, Toronto ON M4H 1N6.

Notes